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ECOLOGY

Cyanogenesis in savanna grasses

Abstract

The grass *Cynodon dactylon* is a successful widespread grass of African grasslands. Grasses in this genus are known to produce cyanide. Fifteen common savanna species of grass in the Naivasha area were tested using picric acid paper, which changes colour in the presence of cyanide, to determine whether a cyanogenic capacity is a common trait. Of the species tested only *C. dactylon* was found to produce cyanide. Individuals of *C. dactylon* from an area of high grazing intensity and an area of low grazing intensity were compared to determine the effects of vertebrate herbivory on the level of cyanide production. A reduced variance in cyanide concentration was found in the plants on highly grazed pasture. This result suggests a response to a more even grazing pressure on heavily grazed land although alternative explanations such as, selection by large grazers for an higher cyanide concentration or a low variability due to the plants being clonal relatives, are possible. Individuals of *C. dactylon* under low grazing pressure were experimentally treated to simulate insect herbivory. No significant effect was observed although an insignificant trend to increased cyanide production in the treated plants was observed.

Peter Hayward, University College London, UK

Marcus Hohl, University of Zurich, UK

1999

Density dependent relationship between *Dactylopius opuntiae*, *Opuntia vulgaris* and *Cheilomenes lunata*

Abstract

The need to understand predator-prey relationship and plant-pest relationship is important for population dynamics. A study on density - dependent relationship between *Cheilomenes lunata* and *Dactylopius opuntiae* on *Opuntia vulgaris* was conducted at Carnelly's plot Naivasha, Kenya in July 2000. Fifty affected *Opuntia vulgaris* were selected and the number of *Dactylopius opuntiae* and *Cheilomenes lunata* were counted from a measured portion of each sampled shoot. The study concluded a significant positive density dependent relationship between the *Cheilomenes lunata* and *Dactylopius opuntiae* and a significant negative relationship between *Dactylopius opuntiae* and *Opuntia vulgaris*. It is recommended to investigate more about the negative relationship, to see if the environmental factors contribute to the decrease of *Dactylopius opuntiae* with the increase of *Opuntia vulgaris*.

Joyce Katjirua, University of Namibia, Namibia

Raymond Killenga, East Usambara Conservation Area Management Programme, Tanzania

2000

The effect of air pollution on lichen distribution, diversity and abundance in Hell's Gate National Park

Abstract

The affect of airborne pollution from the geo-thermal power plant in Hell's Gate National Park on lichen cover, diversity and height was investigated in this study. Sampling of lichens focused on two tree species, *Acacia drepanolobium* and *Tarchonanthus camphoratus*, and was carried out in three areas of the park, one heavily impacted by the power plant and two control sites. As lichens are well-documented indicators of air pollution, it was expected that lichen distribution and abundance would be negatively affected by air pollution. The results showed a gradient of increasing lichen cover and diversity with increasing distance from pollution discharge points. Transects upwind of these points also showed greater cover, diversity and height than those downwind of the pollution points. Comparisons between the three sites revealed significantly higher cover, diversity and height at one control site. In the other control site only cover was significantly higher than that of the polluted area. The results suggest that pollution is affecting lichen at a small scale in the vicinity of the power plant. The picture for the whole park is less clear with other environmental factors possibly affecting lichen distribution and abundance.

Seline Meijer, Wageningen University, The Netherlands

Simon O'Moore Donohoe, University College Dublin, Ireland

2006

Interaction between soils, plant species and herbivores at different altitudes in Hell's Gate National Park

Abstract

Soil, vegetation cover and diversity, and number of herbivores present at different land gradients in three randomly selected sites in Hell's Gate National Park were studied. Four areas were selected per site representing different land gradients: top of slope, slope, transition and base. Findings obtained in this study show no significant influence of topography on soil moisture, soil Ph and soil particle sizes; neither did soil significantly affect vegetation. However, herbivore presence at the top of the slope, on the slope, in the transition and the base influenced vegetation composition significantly. The defined land gradients also influenced wildlife distribution.

Naa Adorkor Saka, Kwame Nkrumah University of Science and Technology, Ghana

Loiy Elsir Ahmed, Khartoum University, Sudan

Doreen Munthali, University of Malawi, Malawi

2007

The potential effects of clustered distribution of Sodom apple (*Solanum incanum*) on mega herbivores and their implication for wildlife management in Hell's Gate National Park

Abstract

This study investigated the effect of the invasive plant *Solanum incanum* in Hell's Gate National Park on associated vegetation growth and mega herbivore presence. Randomly selected patches of *Solanum* were compared with adjacent plots containing few or no conspecifics by recording various plant characteristics, associated grasses, soil parameters, and dung counts. The apparent clustered distribution of *Solanum* in grassland areas was confirmed. The results showed that there was a significant difference between grass heights inside the *Solanum* patches and outside patches. In

addition, we found a significant difference between dung counts inside and outside solanum patches. It was also observed that *S. incanum* appears to facilitate increased growth of associated grasses in both types of plot. There was no significant difference in measured soil properties (pH, moisture content, particle size) for both patch types. Suggestions for management of this invasive plant in relation to fire risk and access to grazing are discussed.

Alex Tumukunde, Institute of Tropical Forest Conservation, Uganda

Jackline Herman Ngowi, University of Dar-es-Salaam, Tanzania

2007

POLLINATION

Aspects of the pollination biology of *Euphorbia candelabrum*

Abstract

Euphorbia candelabrum is an important savanna tree species, native to Africa, whose pollination biology has been relatively little studied. Analyses of insect activity around flowering trees and the pollen load carried by these visitors strongly supports the idea that flies are important pollinators of this species. An analysis of the *Euphorbia* inflorescences' nectar indicates the potential benefits that may accrue to the flies in return for this transfer of pollen.

Ruth Kahurananga, UNDP-GEF, Tanzania

Harriet Hunt, University of Cambridge, United Kingdom

1999

An investigation into floral morphology and pollination aspects of *Cotyledon barbeyi*, *Kalanchoe lanceolata* (Crassulaceae) and *Plectranthus pseudomarrubioides* (Labiatae)

Abstract

An investigation into the floral morphology and pollination aspects of *Cotyledon barbeyi* (Crassulaceae), *Kalanchoe lanceolata* (Crassulaceae) and *Plectranthus pseudomarrubioides* (Labiatae) was carried out. The three species differed significantly in their morphology, nectar sugar concentration and volume. Bees (Apidae) were most frequent visitors and potential pollinators of *C. barbeyi* and *P. pseudomarrubioides*. The Variable Sunbird, *Nectarinia venusta* was another frequent visitor and possible pollinator observed on *C. barbeyi*. Only three insects overall were observed on *K. lanceolata* and their role in its pollination was not clear. The number of bee visitors increased with increasing density of *C. barbeyi* inflorescences while the number of visitors to each inflorescence declined with increasing inflorescence density.

Ratidzayi Takawira, National Herbarium and Botanic Garden, Zimbabwe

Mette Elisabeth Bramm, University of Aarhus, Denmark

1999

A comparison of floral visits on indigenous and exotic flowers at Elsamere Field Study Centre, Kenya

Abstract

A comparison of floral visits on four pairs of indigenous and exotic flowers (*Markhamia lutea* Seem. ex Baillon and *Cassia spectabilis*; *Senna didymobotrya* Fresen. and *Canna* sp.; *Cotyledon barbeyi* L. and *Tecomaria capensis* (Thunb.) Spach; *Hibiscus fuscus* L. and *Asteraceae* sp.) was carried out at Elsamere Field Study Centre, Naivasha, Kenya in July 2004. Observations showed that indigenous flowers attract more visitors than exotic ones. One exotic species, *T. capensis*, showed a high number of visitors, but less diversity compared to the indigenous one. The number of floral visits varied depending on daytime for both indigenous and exotic plant species. The amount of sugar content in nectar played a significant role in attracting visitors.

Guluma Fekadu, Institute of Biodiversity Conservation, Ethiopia

Cornelia Rüegg, Swiss Federal Institute of Technology, Switzerland

2004

Pollination ecology of *Hypoestes forskahlii*

Abstract

Pollination ecology of most flowering plants has received little attention from many biological researchers. This growing trend can lead to an adverse effect on both agriculture and nature conservation. This study was therefore conducted to examine the floral phenology and temporal nectar characteristics as well as flower visitation patterns in relation to nectar volumes and concentration of the abundant herb, *Hypoestes forskahlii* (Acanthaceae).

The results obtained show that *H. forskahlii* is protandrous (i.e. has a male and female phases) and its flowers are functional for between two to three days. Small volumes of relatively concentrated nectar were available on the first day of flowering. Visitors were recorded over the course of four days observations and comprised honeybees, butterflies flies and wasps; behaviours suggested bees were the most likely pollinator.

Alfred Hounnon, University of Parakou, Benin

Emmanuel Kogo, Kwame Nkrumah University of Science and Technology, Ghana

2006

TREES

Age structure, regeneration pattern and spatial distribution of *Tarchonanthus camphoratus* and *Acacia drepanolobium* in Hell's Gate National Park, Kenya

Abstract

A study of the age structure, regeneration pattern and spatial distribution of the two co-dominant plant species, *Tarchonanthus camphoratus* and *Acacia drepanolobium*, was carried out in Hell's Gate National Park, Kenya. Age structure (measured by allotting 4 size classes) was represented in both species with sufficient saplings, but *T. camphoratus* was more frequent, contributing 75.25% of the combined population as compared to *Acacia* with 24.75%. The spatial distribution was non-random, highly aggregated and 5 of 8 age classes were significantly skewed. Furthermore the occurrence of the two tree species was increasingly positively correlated as the trees got older, leading to a distribution pattern of older trees being even more aggregated than that of the younger ones.

Jonathan Dehinbo Ayonniyi, University of Ibadan, Nigeria

Lukas Zimmermann, University of Bern, Switzerland

1999

Age structure and regeneration of *Acacia xanthophloea*

Abstract

This project investigated the age structure of *Acacia xanthophloea* and its regeneration potential, in four sites near Elsamere. According to our findings, seedlings were found to occur mostly in areas of open canopy. They were particularly common at the shore where there is more light. Their spacing to the nearest adult trees was also found to be greater than that between adult trees which indicates that they are growing in open areas where adult trees are not prevalent. Our findings reveal that the most important factor affecting the regeneration of the trees is canopy openness. Probably owing to the fact that the trees are light demanding, the age structure shows that seedlings are concentrated mostly near the lake while adult trees away from the lake.

Fekade Haile Mariam, Ethiopia Heritage Trust

Rainer Freimbacher, University of Vienna

2000

Differences in defence mechanisms among different age classes of *Acacia drepanolobium* species

Abstract

This study investigated the defence mechanisms in different ages of *Acacia drepanolobium* in two areas of different browsing pressures (Hell's Gate National Park and Fisherman's Upper Camp). The results show that trees in browsed areas invest less in spine defence when older, suggesting that defence mechanisms differ according to changes in browsing impact as the tree grows. Ant defence seems to be more important as the tree gets older in both sites. More active and aggressive ants and lower spine density were found in areas of high browsing pressure implying the importance of ant defence. In addition we found two species of ants that so far have not been reported from the study area.

Alice Chepngeno Bett, Kenya Wildlife Service, Kenya

Kristina Karlsson, University of Goteborg, Sweden

Hala Sulieman Abbas, University of Khartoum, Sudan

2004

Influence of Lake Naivasha on population structure and abundance of Fever Tree (*Acacia xanthophloea*)

Abstract

Acacia xanthophloea is found around lakes and rivers, and thus it is associated with high water table. Levels of water table around water basins depend on the distance and height thereof. Thus our study was aimed at determining the population structure and abundance of the fever tree with distance and height from the lake. As the study site is mainly used for human settlement, we also wanted to determine the effect of human activities on population structure and abundance around the lake. Line transects of 20 by 450 m were made 50 m from the lake. Each transect was divided into 4 quadrats of 20 by 50 m, 50 meters apart from the last two, due to road effect. The following parameters were recorded per transect: Distance from the lake, height above lake, height of tree, population structure, and a description of the site was given. Basal area was calculated at a later stage. Some of the results obtained were inline with the predictions, but there were a few interesting findings: height and distance from the lake do not influence the abundance of seedlings and saplings, but influence the abundance of trees. Disturbance does not influence the abundance of *A. xanthophloea*.

Clara Mukaru, University of Namibia, Namibia

Dickens Odeny, National Museums of Kenya, Kenya

2004

***Acacia drepanolobium* regeneration in Hell's Gate National Park**

Abstract

Acacia drepanolobium is a key stone species in the savanna ecosystem therefore; the persistence of this species is of great importance to all the other species, plants and animals, in this ecosystem. We studied the seed production, seed bank, seed predation, and seedling density of *A. drepanolobium*, as an indicator of its regeneration potential, at Hell's Gate National Park, and compared this to the Elsamere Field Study Center population. We found that reduced seed output and dispersal, intensive browsing, high seed predation, and lower seedling establishment are the probable reasons for low recruitment of *A. drepanolobium* at Hell's Gate National Park. We think the most important factor affecting the seed bank at Hell's Gate National Park is predation by rodents and ants and the most important factor affecting the seed production is browsing.

Ana Rita T. Martins, Lisbon University, Portugal

Hildegarde Aloyce, Sokoine University of Agriculture, Tanzania

Yahkat Barshep, University of Jos, Nigeria

2006

Distribution patterns of *Acacia drepanolobium* (Mimosaceae) in Hell's Gate National Park along an altitudinal gradient

Abstract

The distribution pattern of *Acacia drepanolobium* along an altitudinal gradient was studied at Hell's Gate National Park. The diameter, altitude, leaf length were measured, height class and number of dead plants were recorded from a total of 38 plots in six transects. Altitude was found not to influence number of *Acacia* plants, diameter, leaf length and height, except for trees above 3M in

height. The highest numbers of tree were found at altitude of between 1881-1900m and in Open Acacia Woodland vegetation type. We found that the distribution of trees was aggregated and their regeneration rate satisfactory. Out of the 699 plants recorded, 96% were alive and 4% dead.

Coney Olanya, Makerere University Kampala, Uganda

Fanny Rakotoarivelo, University of Antananarivo, Madagascar

2006

Influence of different trees on plants species richness in Elsamere Nature Trail, Naivasha, Kenya

Abstract

The influence of three isolated trees of *Tarchonanthus compharatus*, *Acacia drepanolobium* and *Acacia xanthophloea* in Elsamere Nature Trail were investigated by studying the composition and richness of other plant species at different distances from the tree bases. Findings obtained in this study showed no significant influence in species richness and composition with respect to different distances from tree stems. Likewise, the pH and temperature values also showed no influence in species richness and composition for three tree species. The results suggested that influence of the three trees on species richness and composition is influenced by other environmental and abiotic factors, including amount of nutrients, soil water potential and light. Distance from tree stem is only one factor amongst these.

Joshua Wambua, Nature Kenya, Nairobi Kenya

Mohanad Abdel Gadir Ali, Wildlife Research Centre, Sudan

Gladys Ng'umbi, TANAPA Arusha, Tanzania

2006

Variation in allocation of mechanical defence resources in *Acacia drepanalobium* at different foraging regimes around Hell's Gate National Park, Kenya

Abstract

Variation in allocation of mechanical defence resources in *Acacia drepanalobium* plants in different foraging regimes was investigated around Hell's Gate National Park, Kenya. Plant architectural attributes (representing mechanical defence) were sampled in 90 individual trees located along transects placed within three foraging regimes, namely: heavily-browsed, moderately-browsed and un-browsed. 30 trees were sampled in each category. There was a significant increase in defence attributes (thorn size and density, mean inter-spine distance) with increasing browsing intensity. On the contrary, trees in the unbrowsed and moderately-browsed area had larger leaf sizes than those in the heavily browsed areas. The study concluded that plants allocated more defence resources with increasing browsing intensity, which had ramifications on plant growth through reduced leaf production. This could have produced the stunted tree growth found in the highly browsed area. Thus, our findings suggest that foraging intensity does influence plant architecture.

Richard Chepkwony, Kenya Wildlife Service, Kenya

David Maleko, Sokoine University of Agriculture, Tanzania

Woldemedhin Zebene Mulatu, Frankfurt Zoological Society, Ethiopia

2007

Variation in *Acacia drepanolobium* defence by *Crematogaster mimosae* and a previously undescribed acacia ant at Hell's Gate National Park, Kenya

Abstract

An as yet unidentified brown ant species associated with *Acacia drepanolobium*, found in Hell's Gate National Park, Kenya, was compared to the well known acacia ant *Crematogaster mimosae* in terms of tree guarding behaviour against herbivory. Baseline information was also collected on its activity patterns and pseudogall occupancy. The brown ants were found to be significantly less aggressive than *C. mimosae*, and were also present at a lower abundance on the acacia trees. The location at which the trees were artificially 'browsed' affected the level of recruitment of ant guards for both species, with more ants being recruited at basal locations rather than at shoot tips, suggesting an effect of proximity to inhabited pseudogalls. Brown ants were found to occupy trees that were taller and healthier than *C. mimosae* trees, but the nectaries of brown ant acacias were significantly smaller than those of trees hosting *C. mimosae*. The brown ants appear to be poor defenders of *A. drepanolobium* against megaherbivores, and their place within the ant succession on *A. drepanolobium* is still unclear, as are their effects on tree trade-offs in plant resource allocation to defences.

Clare Elliott, University of Nottingham, United Kingdom

Christina Ieronymidou, Imperial College London, Cyprus

Evelyn Fosuah, Kwame Nkrumah University of Science and Technology, Ghana

2007
